INSIGHT

Trial Exam Paper

2009

BIOLOGY

Written examination 1

STUDENT NAME:

QUESTION AND ANSWER BOOK

Reading time: 15 minutes
Writing time: 1 hour 30 minutes

Structure of book

Section	*Number of questions*	*Number of questions to be answered*	*Number of marks*	*Suggested times (minutes)*
A	25	25	25	30
B	8	8	50	60
			Total 75	90

- Students are permitted to bring the following items into the examination: pens, pencils, highlighters, erasers, sharpeners and rulers.
- Students are NOT permitted to bring sheets of paper or white out liquid/tape into the examination.
- Calculators are not permitted in this examination.

Materials provided

- The question and answer book of 21 pages.
- An answer sheet for multiple-choice questions.

Instructions

- Write your **name** in the box provided and on the answer sheet for multiple-choice questions.
- You must answer the questions in English.

At the end of the examination

- Place the answer sheet for multiple-choice questions in the front cover of the question and answer book.

Students are NOT permitted to bring mobile phones or any other electronic devices into the examination.

SECTION A – Multiple-choice questions

Instructions for Section A

Answer **all** questions in pencil on the answer sheet provided for multiple-choice questions.

Choose the response that is **correct** or that **best answers** the question.

1 mark will be awarded for a correct answer; no marks will be awarded for an incorrect answer.

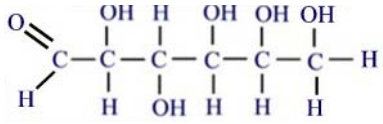
Marks are **not** deducted for incorrect answers.

No marks will be awarded if more than one answer is completed for any question.

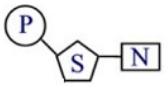
Question 1

A polymer could be represented by

A.



B.



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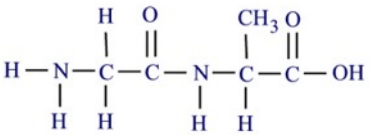

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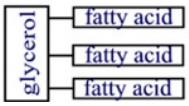


The following information is relevant for Questions 2 and 3.

Proteins are large molecules usually comprised of many amino acids which are joined together by peptide bonds to form a primary structure. The overall structure of a protein can be very complex.

Question 2

The principle difference between the tertiary and quaternary structure in proteins is that a protein with a quaternary structure

A. always has two or more polypeptide chains bound together.

B. shows greater tolerance of heavy metals.

C. will show either α-helices or β-pleated sheets, but not both.

D. will only display hydrogen and peptide bonding.

Question 3

Some proteins, such as haemoglobin, incorporate other chemical groups within the amino acid chains. These proteins are known as

A. complementary.

B. conjugated.

C. dysfunctional.

D. defective.

Question 4

Animal cells contain many organelles, all of which perform specific functions. The sac-like, membrane-bound organelle which contains dissolved digestive enzymes for the destruction of substances no longer needed by a cell is the

A. endosome.

B. peroxisome.

C. melanosome.

D. lysosome.

Question 5

There are three types of junction that are found in animal cells. Which of the following is NOT a junction found in animal cells?

A. occluding

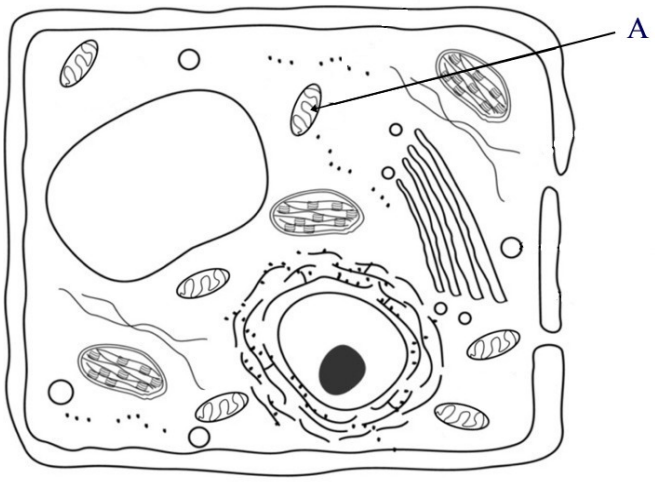
B. bridging

C. communicating

D. anchoring

Question 6

The diagram shows a 'typical' plant cell. Structure **A** is directly associated with



A. the conversion of radiant energy to chemical energy.

B. the breakdown of glucose to pyruvate.

C. the production of glucose.

D. the production of ATP.

Question 7

Anaerobic respiration in yeast is known as

A. condensation.

B. fermentation.

C. hydrolysis.

D. glycolysis.

Question 8

In living organisms metabolic reactions cannot take place efficiently without the involvement of enzymes. The rate of an enzyme reaction is NOT influenced by

A. pH.

B. temperature.

C. concentration of enzyme and substrate.

D. the position of the active site in the substrate.

Question 9

Cyanide is a chemical that is known to inhibit the activity of *cytochrome c oxidase,* an enzyme involved in electron transport in aerobic respiration. Enzyme inhibition occurs when other molecules

A. compete with the normal substrate for the active site of the enzyme.

B. compete with the normal enzyme for the active site of the substrate.

C. alter the tertiary structure of the enzyme.

D. alter the tertiary structure of the substrate.

Question 10

Single gene defects can cause genetic diseases in humans. Gene therapy is a biomedical process that can correct some gene defects. Which of the following would NOT be used in gene therapy?

A. Treatment of Parkinson's disease by introducing liposomes.

B. Treatment of severe combined immunodeficiency (SCID) using retroviruses.

C. Treatment of PKU by reducing intake of phenylalanine.

D. Treatment of cystic fibrosis by applying adenoviruses into the lungs.

The following information is relevant for Questions 11 to 13.

The influenza virus has two proteins on its surface. The first, haemagglutinin, is used by the virus to gain entry to a cell and the other, neuraminidase, enables newly formed viruses to leave a host cell by severing the attachment between host cell and newly formed virus. Efforts to find a treatment that would block viral entry to a cell failed, however, a strategy which prevented viral particles from leaving a host cell was successful.

Question 11

The technique used to find the treatment for influenza is known as

A. rational drug design.

B. trial and error.

C. chorionic villus sampling.

D. screening.

Question 12

Neuraminidase is

A. an enzyme.

B. a glycoprotein.

C. an antibody.

D. a microfibril.

Question 13

An anti-influenza virus drug has been developed with the generic name Zanamivir. When Zanamivir is present in the body of a host it will bind to

A. the haemagglutinin protein on the plasma membrane of the host.

B. the neuraminidase protein on the plasma membrane of the host.

C. the haemagglutinin protein on the outer layer of the influenza virus.

D. the neuraminidase protein on the outer layer of the influenza virus.

Question 14

Exteroceptors are highly specialised cells that receive information from the external environment of an organism. Information is received and converted to a chemical signal which is then transferred through body cells. The exteroceptor that responds to pressure, tension and sound vibrations is a

A. thermoreceptor.

B. photoreceptor.

C. chemoreceptor.

D. mechanoreceptor.

Question 15

The development of a tadpole into an adult frog (metamorphosis) is controlled by the hormone thyroxine. Instead of thyroxine concentrations being maintained within a set range, the levels rise and trigger metamorphosis. This is an example of

A. negative feedback.

B. positive feedback.

C. metabolism.

D. homeostasis.

Question 16

Thyroxine is a hormone which is released from the thyroid gland into the bloodstream. It is transported through the circulatory system until reaching target cell receptors around the body. Thyroxine is synthesised from the amino acid tyrosine and

A. can move through the plasma membrane of the cell because it is small and hydrophobic.

B. can move through the plasma membrane of the cell because it is small and hydrophilic.

C. binds with a receptor protein on the plasma membrane.

D. binds with a target protein on the plasma membrane.

Question 17

Ethylene is a gas produced by some but not all ripening plants. The petals of the chrysanthemum *Chrysanthemum morifolium* also produce ethylene which leads to the death of the flower. The graph shows levels of ethylene produced by *Chrysanthemum morifolium* flowers after cutting.

The increase in ethylene level at Day 4 is most likely due to

A. decreased rate of cellular respiration in the cells of the petals.

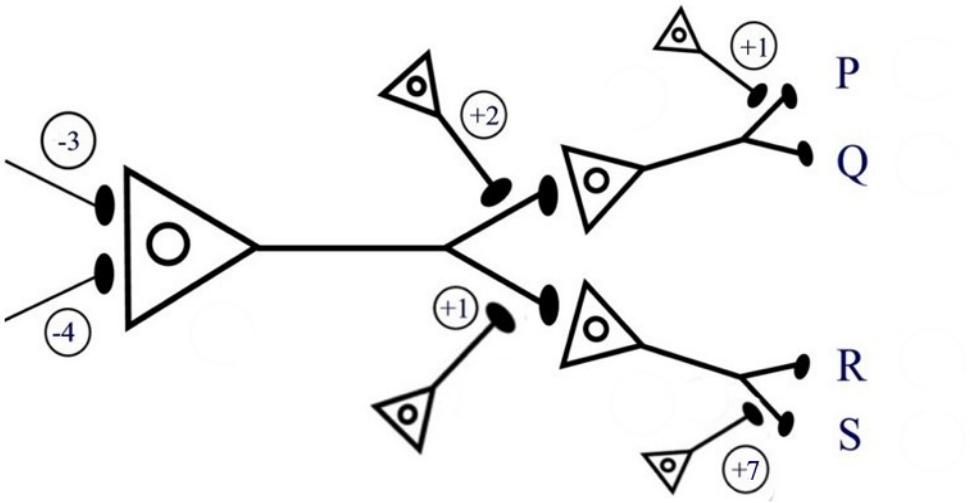
B. decreased rate of photosynthesis in the cells of the petals.

C. increased rate of cellular respiration in the cells of the petals.

D. increased rate of photosynthesis in the cells of the petals.

Question 18

Neurons interact in networks to enable the functioning of an organism. Signals can either excite (+) or inhibit (-) processes. If an excitation signal and an inhibition signal are given to the same neuron at the same time, they will cancel each other out. The diagram shows a network of neurons associated with a muscle fibre. Which of the four target cells P, Q, R or S will receive a signal from the neurons?



A. Target cells P and Q

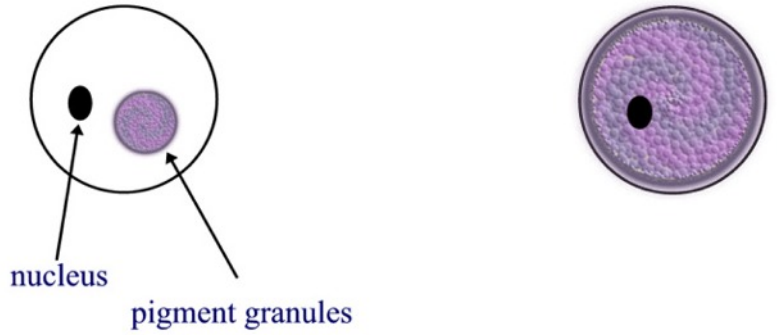
B. Target cells R and S

C. Target cell P only

D. Target cell S only

Question 19

Vertebrates gain their colours from pigments which are found in pigment cells or structures which have differentiated from these cells. Pigment cells have a fixed shape; however, the distribution of pigment within the cells is changeable.



A - concentrated pigment granules B - dispersed pigment granules

When threatened, octopuses are capable of expressing colour change within seconds. In contrast, *Lepus americanus*, the snowshoe hare, changes coat colour over a period of weeks from white in winter to brown in summer. The change in coat colour of snowshoe hares is controlled

A. mainly by the nervous system.

B. entirely by the nervous system.

C. mainly by the endocrine system.

D. entirely by the endocrine system.

The following information is relevant for Questions 20 and 21.

Severe acute respiratory syndrome (SARS) is caused by a corona virus which is spread by respiratory droplets from infected individuals.

Question 20

When a person is infected with the SARS virus, the virally infected cells are most likely to be ingested by a kind of phagocyte known as a

A. macrophage.

B. bacteriophage.

C. viroid.

D. lymphocyte.

Question 21

Following ingestion, viral peptides are displayed on the surface of the phagocyte. The appearance of the viral peptides activates an immune response mediated by

A. B plasma cells.

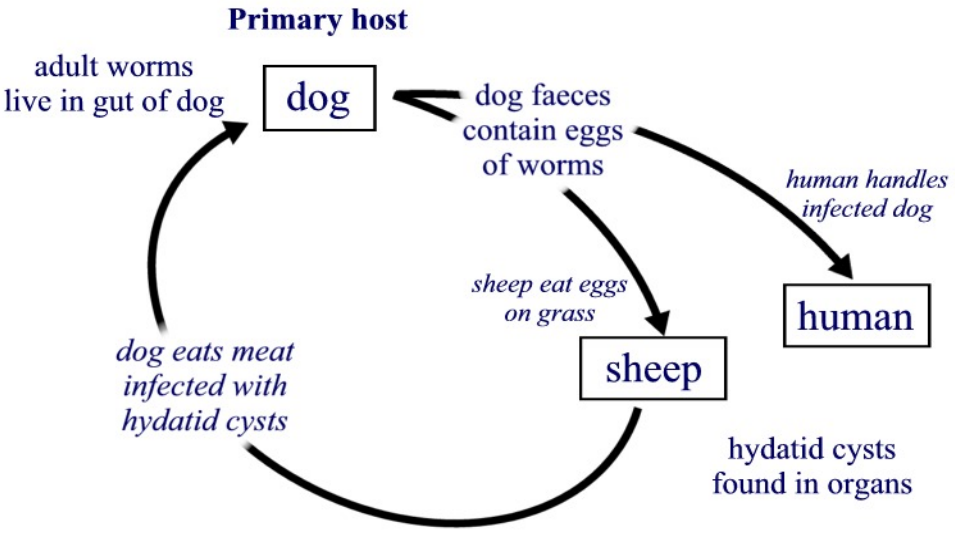
B. mast cells.

C. suppressor T cells.

D. helper T cells.

Question 22

The adult hydatid tapeworm *Echinococcus granulosus* lives in the intestine of a dog. The lifecycle of *E. granulosus* is described in the diagram. Which of the following statements is NOT true?



A. The human and the sheep are intermediate hosts in this lifecycle.

B. Dogs produce faeces containing hydatid cysts which can be transferred to humans and sheep.

C. Hydatid cysts contain large numbers of tapeworm heads that can develop into worms.

D. Hydatid cysts are typically found in organs such as the liver, brain and lungs.

The following information is relevant for Questions 23 and 24.

The egg in which a chicken embryo develops is comprised of amniotic fluid (the white) and the yolk which is a source of nutrition. Immunoglobulins are transferred from a mother hen into the developing egg.

Question 23

An immunoglobulin is best described as

A. a group of proteins associated with building resistance against viral infection.

B. a group of blood proteins involved in the body's second line of defence.

C. a protein molecule capable of initiating antibody production.

D. an antibody molecule found in body fluid and on the surface of B cells.

Question 24

The immunoglobulins present in the newly hatched chick will give

A. long-lasting passive immunity.

B. long-lasting active immunity.

C. temporary passive immunity.

D. temporary active immunity.

Question 25

Diabetes mellitus is an autoimmune condition in which the body is unable to regulate blood glucose levels, resulting in excessively high levels of glucose in the blood. Which of the following statements does NOT apply to autoimmune disease?

A. Failure of the body's self-recognition system

B. Disease of the immune system, like AIDS

C. Immune system reacts against its own tissues

D. No distinction made between self cells and invading micro-organisms

END OF SECTION A
TURN OVER

SECTION B – Short-answer questions

Instructions for Section B

Answer this section in **pen**.
Answer **all** questions in the spaces provided.

Question 1

In humans, metabolism is dependent on the intake of organic molecules. Particular organic molecules are consumed and processed during digestion. Once digested, organic material can be broken down and reorganised into molecules that have specific functions throughout the body.

1a. Complete the table.

Molecule	Function	Example
W	regulates blood glucose levels	
X		glycogen
Y		DNA
Z	stimulates development of female reproductive system	

2 marks

1b. What type of organic molecule is Molecule **Z**?

_____

1 mark

1c. In terms of function, what is the plant equivalent of Molecule **X**?

_____

1 mark

The following information applies to Question 1d.

The nucleotide base sequence of a strand of DNA which codes for a specific amino acid is shown below.

G G A A T G C T C G A C A T G

1d i. What is the base sequence of the complementary strand?

_____

1 mark

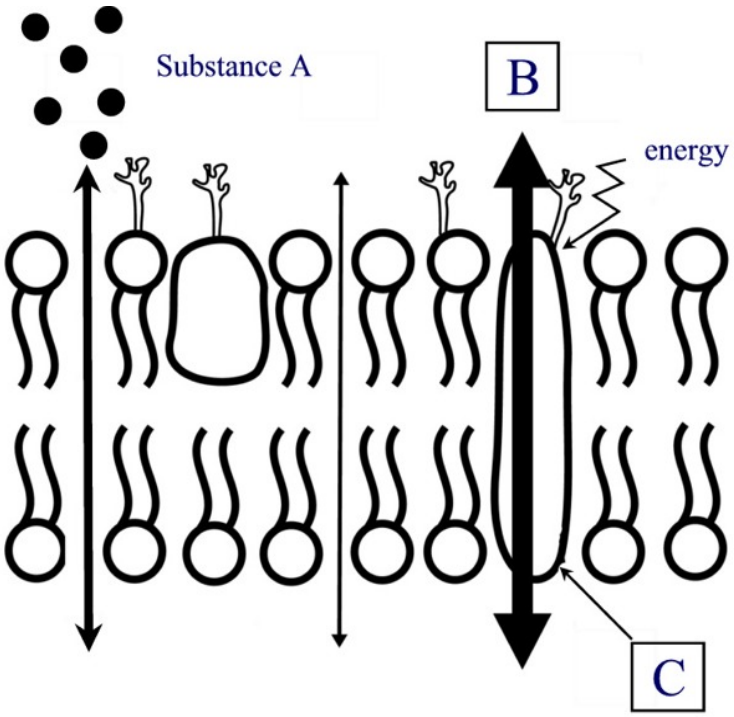
1d ii. How many amino acids are coded for by this strand of DNA?

_____

1 mark
Total 2 + 1 + 1 + 1 + 1 = 6 marks

Question 2

The plasma membrane encloses a cell and is involved in the selective regulation of the movement of substances in and out of the cell. A cross-sectional representation of part of a plasma membrane from a eukaryotic cell is shown in the diagram.



2a i. Suggest a name for Substance **A**.

_____

1 mark

2a ii. Name one characteristic that would be demonstrated by Substance **A**.

_____

_____

1 mark

2b. Explain the process that would occur at **B**.

_____

_____

_____

2 marks

2c i. What is Structure **C**?

_____

1 mark

2c ii. Apart from using Structure **C**, by what other means could a large, lipid-insoluble molecule gain entry to a cell?

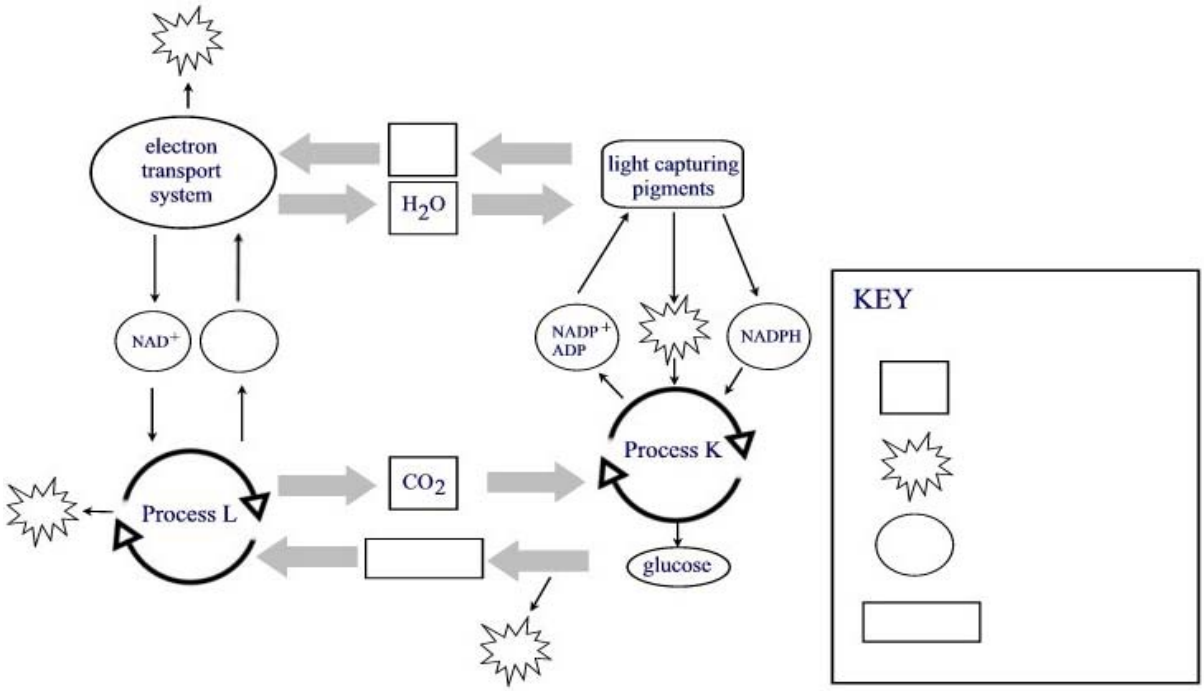
_____

1 mark
Total 1 + 1 + 2 + 1 + 1 = 6 marks

Question 3

In living organisms, the processes of photosynthesis and cellular respiration are closely linked, with the outputs of one becoming the inputs of the other.

The diagram shows the relationship that exists between photosynthesis and cellular respiration.



3a. Provide correct labels for the key to this diagram. Write your answers next to the shapes in the key.

2 marks

3b. What is the name given to Process **K** and where exactly in a cell does it occur?

_____

_____

1 mark

3c. What occurs in the light-dependent phase of photosynthesis?

_____

_____

1 mark

The following information applies to Question 3d.

The water plant *Elodea canadensis* is commonly used as an oxygenator in aquaria. Aquatic plants obtain all their requirements from the water surrounding them. Likewise, they return their gaseous wastes into the same environment. When carbon dioxide dissolves in water, carbonic acid is formed. Phenol red is an indicator that changes colour when the pH of water changes. When the water is acidic the indicator becomes yellow; when water is alkaline, the colour is pink.

It has been hypothesised that green plants take in carbon dioxide during photosynthesis and release carbon dioxide when photosynthesis is not taking place.

3d. Design an experiment to test this hypothesis. Use a diagram to explain your design.

The experimental design should

- clearly outline the experimental procedure that would be followed
- describe the results that would support the hypothesis.

3 marks

Total 2 + 1 + 1 + 3 = 7 marks

Question 4

Human T-cell lymphotropic virus (HTLV) is a human retrovirus that causes T-cell leukaemia and T-cell lymphoma in adults. Of those infected with the virus, approximately 5% will develop cancer.

4a. Explain why viruses are considered to be non-cellular obligate parasites.

_____

_____

_____

2 marks

4b i. What distinguishes a retrovirus from other viruses?

_____

1 mark

4b ii. What is a viroid?

_____

1 mark

4c. Using your knowledge of viral reproduction strategy and the information provided, design a drug that would be effective in treating a viral infection caused by this specific retrovirus. Indicate whether the host is likely to be affected by this virus. Use a diagram in your answer.

_____

_____

_____

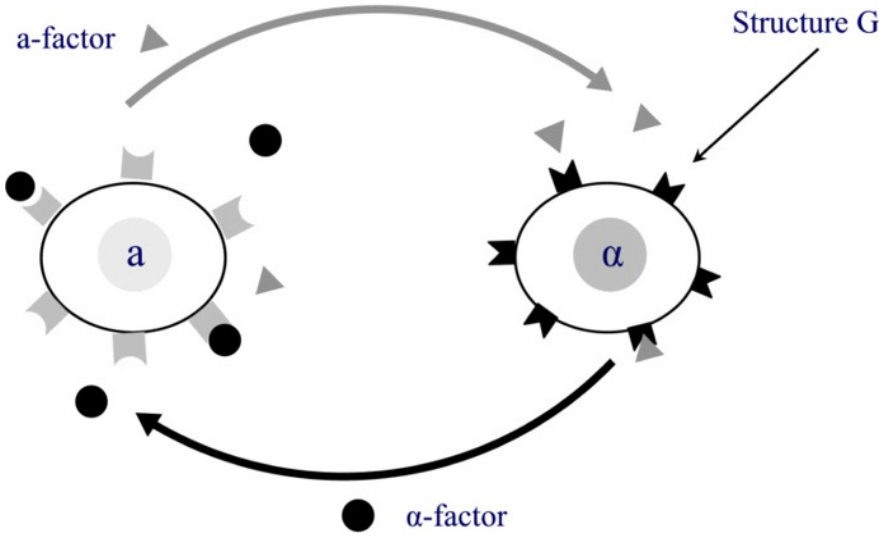
_____

_____

3 marks
Total 2 + 1 + 1 + 3 = 7 marks

Question 5

In the yeast *Saccharomyces cerevisiae*, there are two types, Mating Type **a** and Mating Type **α**. Cells of each type release a chemical signal, **a**-factor and **α**-factor respectively, which cause the cells to draw toward each other until they fuse and mate.



5a. What is Structure **G**?

_____

1 mark

5b i. **Mating Type a** has communicated with **Mating Type α** using a chemical called **a-factor**. What name is given to the type of communication between these cells that leads to the cellular response of mating?

_____

1 mark

5b ii. What is the sequence of stages associated with this process?

_____

1 mark

The following information applies to Questions 5c and 5d.

The diagrams show two examples of cell communication in animals.

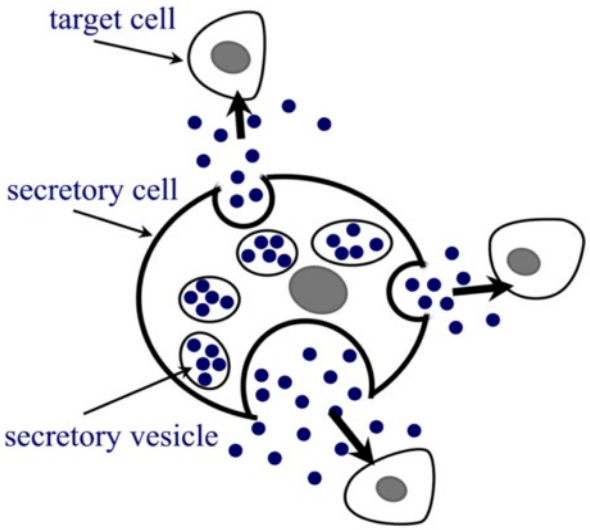


Diagram C

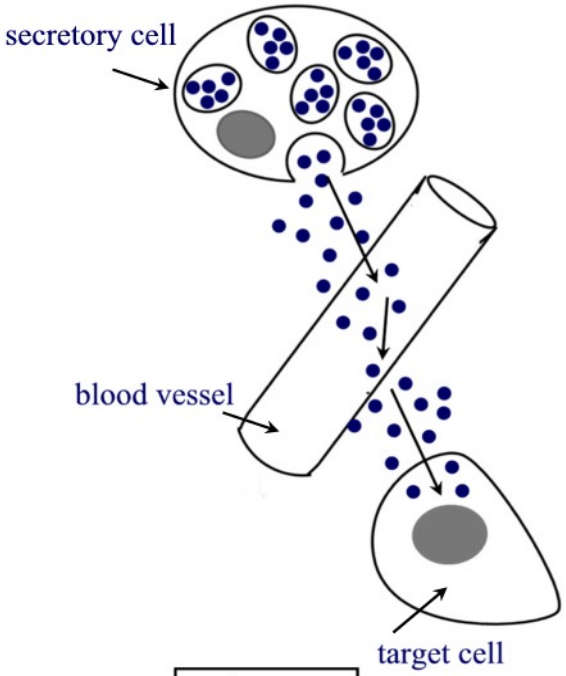


Diagram D

5c. Diagram C

Type of chemical signalling _____

Explain why chemicals involved in this kind of signalling can only be used on nearby cells.

_____

_____

2 marks

Diagram D

Type of chemical signalling _____

Provide a definition of the chemical involved in this signalling.

_____

_____

2 marks

The following information applies to Question 5d.

Substance **W**, released from the secretory cell in **Diagram D** is hydrophobic.

5d i. How will Substance **W** be transported in the blood?

_____

_____

1 mark

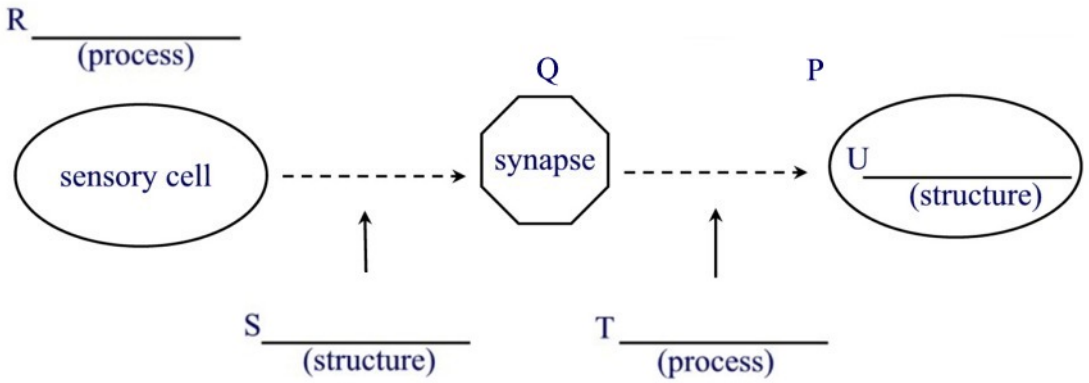
5d ii. Suggest a possible response triggered by Substance **W** when it reaches the target cell.

_____

1 mark
Total 1 + 1 + 1 + 4 + 1 + 1 = 9 marks

Question 6

In the nervous system, the transmission of a signal involves three mechanisms. These are represented in the diagram below.



6a. Complete the diagram by labelling the boxes.

2 marks

6b. What is the process which occurs at **Q** and **P** during a nerve impulse?

_____

1 mark

6c. Give the name of the substance that is fundamental to the process named in Question **6b**. and identify a specific example.

_____

1 mark
Total 2 + 1 + 1 = 4 marks

SECTION B – continued
TURN OVER

Question 7

Gastric ulcers are associated with the use of drugs, such as ibuprofen and aspirin, and also the presence of the spirochaete bacterium *Helicobacter pylori*. In a sample of individuals with gastric ulcers, 95% of the group tested positive for the presence of the bacterium.

7a. What would be the shape of *Helicobacter pylori*?

_____

1 mark

7b. What characteristic is common to all bacteria?

_____

_____

1 mark

7c. How does the bacterium survive in the environment of the stomach?

_____

_____

1 mark

The following information applies to Question 7d.

Antibiotic medication is usually prescribed in the event of a bacterial infection. Sometimes a full course can last for two weeks.

7d. Why is it essential to finish the full course of antibiotics even if the symptoms of the condition have ceased after four days of the treatment?

_____

_____

_____

1 mark
Total 1 + 1 + 1 +1 = 4 marks

Question 8

In 2008, doctors in Spain replaced the damaged trachea (windpipe) of a woman, Claudia Castillo, with a windpipe created from her own stem cells. A donor windpipe was used as a scaffold for the stem cells to grow around. The procedure, a world first, is considered revolutionary because in the past organ transplants have never involved recipient tissue, only donor tissue. In the past, tracheal transplants using donor tissue have been associated with several side-effects including uncontrolled cell death (necrosis) and lethal bleeding.

8a i. What is a stem cell?

_____

_____

1 mark

8a ii. Explain the advantage of Claudia Castillo's tracheal transplant over previous tracheal transplant procedures.

_____

_____

_____

2 marks

It has been standard practice to administer a drug such as cyclosporine to patients after they have received an organ transplant. Cyclosporine works (at a cellular level) to enhance the success of organ transplants.

8b i. What is the name of the process which normally prevents cancer in humans?

_____

1 mark

8b ii. Explain why the use of drugs like cyclosporine might be associated with a higher incidence of cancer in organ transplant patients.

_____

_____

_____

2 marks

8c. What potential does the technique used for Claudia Castillo's tracheal transplant hold for the future of transplant technology?

_____

_____

1 mark

Total 1 + 2 + 1 + 2 + 1 = 7 marks

END OF QUESTION AND ANSWER BOOK